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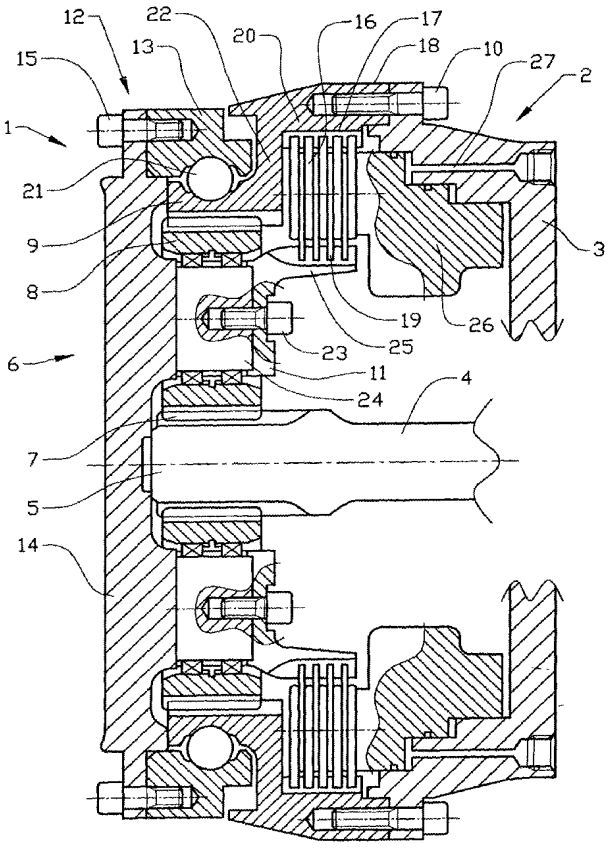
(54) Title: AN ARRANGEMENT FOR DRIVING A WHEEL OF A VEHICLE



(57) Abstract: The invention relates to an arrangement for driving a wheel of a vehicle, which arrangement comprises a planetary gear transmission (6) which in turn comprises a sun gear (7) connected to a driving axle (4), a planet carrier (11), on which at least one planet gear (8) is arranged, which planet gear is also arranged in engagement with the sun gear (7), and a ring gear (9) arranged around and also in engagement with said planet gear. The driving arrangement also comprises a braking device (16) and a wheel hub (12), which hub is connected to the planet carrier (11). The braking device is adapted to brake the planet carrier relative to a static part (18) arranged outside the planet gear carrier in the radial direction. The ring gear (9) and the outer, static part (18) are designed in one piece in the form of an annular member (20).

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An arrangement for driving a wheel of a vehicle

FIELD OF THE INVENTION

The present invention relates to an arrangement for driving a wheel of a vehicle, which arrangement comprises a planetary gear transmission which in turn comprises a sun gear connected to a driving axle, a planet carrier, on which at least one planet gear is arranged, which planet gear is also arranged in engagement with the sun gear, and a ring gear arranged around and also in engagement with said planet gear, which arrangement also comprises a braking device and a wheel hub, which hub is connected firmly to the planet carrier, the braking device being adapted to brake the planet carrier relative to a static part arranged outside the planet carrier in the radial direction.

The invention can be applied in vehicles which are intended to be driven on a relatively flat surface, such as a road, and/or on uneven ground in the country. The invention is especially applicable to a vehicle in the form of a construction machine, such as a wheel loader or an articulated or frame-steered vehicle (what is known as a dumper), but can also be applied in, for example, a truck.

Such a driving arrangement is usually arranged at a wheel arranged at each end of a driving axle, and the gear itself is usually referred to as a hub reduction gear. The driving axle is in turn in two parts, and the parts are connected centrally by a differential gear.

PRIOR ART

US 6,090,006 describes a driving arrangement comprising a planetary gear transmission. A sun gear of the planetary gear transmission is driven by a driving axle. A number of planet gears are arranged between and in engagement with the sun gear and an outer ring gear. A planet carrier is connected to the planet gears. The

ring gear is in turn connected to a pressure plate of a friction brake. The friction brake is arranged so as to brake the planet carrier in relation to an outer, static part. The brake is therefore arranged outside the planet carrier in the radial direction. Inward in the radial direction, the planet carrier is also connected to a portion of a hub via splines. Said hub portion is arranged on the inside of and mounted on the outer static part via two roller bearings. The hub extends outward in the axial direction from the ring gear, and a hub portion on an outer side of the roller bearings is intended to carry the wheel.

SUMMARY OF THE INVENTION

One object of the invention is to provide a driving arrangement which is more cost-effective to produce in relation to previously known art. Production includes more cost-effective manufacture and/or less time-consuming assembly. The invention also aims to achieve a driving arrangement which affords opportunities for a reduction of the number of component parts in the arrangement and/or a weight reduction.

This object is achieved by virtue of the fact that the ring gear and the outer, static part are designed in one piece in the form of an annular member.

According to a preferred embodiment of the invention, the braking device and the hub are arranged on the planet carrier on different sides of said planet gear. In this way, opportunities are afforded for producing a device which is compact, that is to say requires less space, in the axial direction.

According to another preferred embodiment of the invention, the hub is mounted against the annular member and, to be precise, the hub is mounted against the annular member outside in the radial direction that portion of the annular member which forms the ring gear

and also against said portion. In this way, opportunities are afforded for a device which is compact, that is to say requires less space, in the axial direction.

According to another preferred embodiment of the invention, the bearing arrangement between the hub and the gearwheel comprises at least one row of balls arranged along a circular track and also between races designed in the hub and the ring gear. By virtue of such an arrangement, opportunities are afforded for a device which is cost-effective from the point of view of production and compact in the axial direction.

Further preferred embodiments and advantages of these emerge from the description below and the claims.

BRIEF DESCRIPTION OF THE FIGURE

The invention will be described in greater detail below with reference to the embodiment shown in the accompanying drawing, in which

FIG. 1 shows a diagrammatic, partly cut-away side view of the driving arrangement.

DETAILED DESCRIPTION OF A PREFERRED EMBODIMENT

Fig. 1 shows a driving arrangement 1 in a diagrammatic side view. The driving arrangement 1 is arranged at one end of the axle case 3 of a wheel axle 2. A driving axle 4 extends inside the axle case 3. The driving axle 4 is, at one 5 of its ends, provided with a hub reduction gear 6 in the form of a planetary gear transmission. At its other end, the driving axle 3 is operationally connected to a central gear (not shown) which, via a drive shaft, is driven by the engine of the vehicle. According to conventional art, the planetary gear transmission 6 comprises a sun gear 7, a number of planet gears 8 and a ring gear 9, which are arranged in driving interconnection via teeth. The ring gear 9 is connected firmly to the axle case 3 via screw

joints 10. A planet carrier 11, also known as a planet gear holder, is adapted so as to hold the planet gears 8. To be precise, the planet gears 8 are mounted on the planet carrier 11. The number of planet gears 8 in the preferred embodiment is three, but, within the scope of the invention, the number of planet gears can be one, two, four or more.

A hub 12 intended to carry a wheel (not shown) is mounted outside the ring gear 9 in the radial direction and also against it. The wheel hub 12 is also connected firmly to the planet carrier 11. In the embodiment shown, the hub comprises an annular part 13 and a disk-shaped cover 14 connected firmly to the annular part 13. The annular part 13 is arranged outside the ring gear in the radial direction and is also mounted against it. The annular part 13 and the disk-shaped cover 14 are interconnected firmly via screw joints 15. The cover 14 is arranged outside the planetary gear transmission 6 in the axial direction and protects the latter from the external environment. The hub 12, and to be precise the cover 14, is connected firmly to the planet carrier 11. The wheel is fastened by a conventional fastening device (not shown) on the hub 12, usually a bolt joint.

The driving arrangement also comprises a braking device 16. The braking device 16 consists of a wet brake in the form of a multiple-disk brake. The braking device 16 comprises two sets of brake disks which rotate in relation to one another during operation. A first set of brake disks is connected to a static part 18 arranged outside the planet carrier 11 in the radial direction. The connection consists of a spline joint 17. A second set of brake disks is connected to the planet carrier 11. The connection consists of a spline joint 19. The brake disks are displaceable in the axial direction on said spline joints 18, 19. In a conventional manner, the brake disks belong alternately

to the first set and to the second set. The planet carrier 11, which is connected firmly to the hub 12 and thus has the same speed as the wheel during operation, is in this way braked against the static part 18.

The braking device 16 also comprises a brake piston 26 for applying the brake by pressing the brake disks together and thus increasing the friction between them. A duct 27 for supplying oil for applying the brake is coupled to the brake piston. On an opposite side of the brake disks relative to the brake piston 26, the annular member 20 forms a pressure surface, or stay, against which the disks are brought when the brake is applied.

By means of this type of braking device 16, the wheel is braked directly. By virtue of the fact that the wheel is braked directly, that is to say the braking takes place after the planetary gear transmission 6, a part is braked which has a lower rotation speed relative to the driving axle (the driving axle usually has a speed which is approximately six times higher than that of the wheel). In this way, it is possible to obtain very good adjustability of the braking, which is especially advantageous for application in vehicles which require great braking power within a large speed range. Such a vehicle consists of, for example, a dumper.

The ring gear 9 and the outer, static part 18 are designed in one piece in the form of an annular member 20. In other words, the ring gear 9 and the outer, static part 18 are integrated in the annular member 20.

The annular member 20 has a number of functions such as: it functions as a holder for the planetary gear transmission 6, that is to say it is connected firmly to the axle case 3, it functions as a brake housing for the braking device 16, and it functions as a bearing

unit 21 for mounting the wheel hub 13. In other words, the annular member 20 comprises a first annular portion 9, in the form of the ring gear, which is arranged in a first position in the radial direction. The annular member 20 also comprises a second portion 18, in the form of the outer, static part, which is arranged in a second position at a greater distance in the radial direction than the first portion. The annular member 20 also comprises a portion 22 which lies between the first and second portions and forms the pressure surface for the brake disks, which intermediate portion 22 extends in the radial direction and connects the ring gear 9 and the outer, static part 18.

The bearing arrangement 21 between the hub 13 and the ring gear 9 comprises a row of a number of balls arranged along a circular track between races designed in the hub 13 and the ring gear 9. Such a bearing arrangement is often referred to as a four-point bearing owing to the fact that four surfaces are ground for contact with the balls. In order to form the bearing arrangement, a number of balls are therefore mounted in between the ring gear 9 and the hub 13. In other words, there is no conventional ball bearing between the parts. Race means that a surface area is designed for receiving the balls. This surface area usually has a curved or angled shape.

That the member 20 which comprises the ring gear 9 and the outer, static part 18 is annular is to be understood in a wide sense, and the term annular includes various forms of at least essentially circular structures which are continuous in the peripheral direction.

The braking device 16 and the hub 13 are arranged on different sides of said planet gears 8. To be precise, the braking device 16 is arranged on the planet carrier 11 for direct braking thereof relative to the annular

member 20. The hub 13 is in turn connected firmly to the planet carrier 11. The planet gears 8 are mounted on pivots 24 which project from the disk-shaped cover 14. That part 25 of the planet carrier 11 which forms the brake housing is connected to the pivots 24 via screw joints 23. According to an alternative embodiment, the planet carrier part 24 and the brake housing part 25 are formed in one piece.

The invention is not to be regarded as being limited to the illustrative embodiments described above, but a number of further variants and modifications are conceivable within the scope of the patent claims which follow. For example, the application may differ, or the engine of the vehicle may be arranged so as to drive the driving axle 4 directly, that is to say without an intermediate drive shaft and central gear.

Figure 1 shows the bearing arrangement in the form of a row of balls which are received in races in the hub and the ring gear. Alternatively, it is possible to imagine a number of rows of balls, which rows are arranged with a mutual spacing in the axial direction. This type of bearing arrangement is usually referred to as an angular contact bearing. According to another alternative, other types of bearing arrangements can be used, such as roller bearings and then in particular conical roller bearings.

PATENT CLAIMS

1. An arrangement for driving a wheel of a vehicle, which arrangement comprises a planetary gear transmission (6) which in turn comprises a sun gear (7) connected to a driving axle (4), a planet carrier (11), on which at least one planet gear (8) is arranged, which planet gear is also arranged in engagement with the sun gear (7), and a ring gear (9) arranged around and also in engagement with said planet gear, which arrangement also comprises a braking device (16) and a wheel hub (12), which hub is connected firmly to the planet carrier (11), the braking device being adapted to brake the planet carrier relative to a static part (18) arranged outside the planet carrier in the radial direction, characterized in that the ring gear (9) and the outer, static part (18) are designed in one piece in the form of an annular member (20).

2. The arrangement as claimed in claim 1, characterized in that the braking device (16) and the hub (12) are arranged on the planet carrier (11) on different sides of said planet gear (8).

3. The arrangement as claimed in claim 1 or 2, characterized in that the hub (12) is mounted against the annular member (20).

4. The arrangement as claimed in claim 3, characterized in that the hub (12) is mounted against the annular member (20) outside in the radial direction that portion of the annular member which forms the ring gear (9) and also against said portion.

5. The arrangement as claimed in claim 3 or 4, characterized in that the bearing arrangement (21) between the hub (12) and the annular member (20) comprises at least one row of balls arranged along a circular track and also between races designed in the hub and the annular member (20).

6. The arrangement as claimed in claim 5, characterized in that the bearing arrangement between the hub (12) and the ring gear (9) comprises two rows of balls, which rows are arranged at a mutual spacing in the axial direction of the driving axle (4).

7. The arrangement as claimed in any one of the preceding claims, characterized in that the annular member (20) forms a pressure surface for said braking device (16).

8. The arrangement as claimed in any one of the preceding claims, characterized in that the outer, static part (18) forms a part of a brake housing for the braking device (16).

9. The arrangement as claimed in any one of the preceding claims, characterized in that the annular member (20) is connected firmly to an axle case (3).

10. The arrangement as claimed in any one of the preceding claims, characterized in that the braking device (16) comprises at least one first brake disk, which is connected to the planet carrier (11), and at least one second brake disk, which is connected to the static part (18), and a means (26) for applying a pressure for the purpose of pressing the first and second brake disks together when braking takes place.

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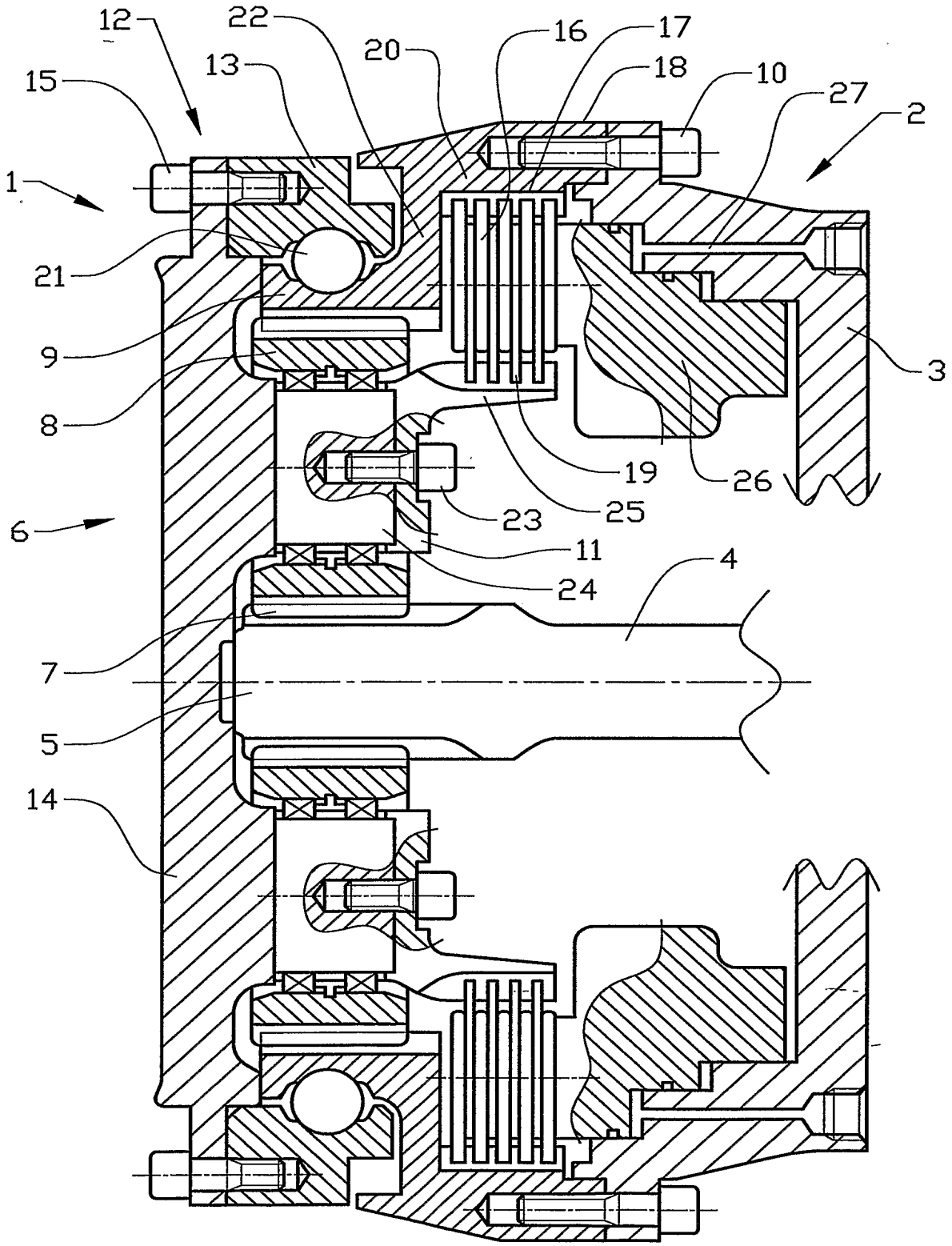

Fig.1

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE 02/01783

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: B60K 17/04, B60T 1/06
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: B60K, F16H

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-INTERNAL, WPI DATA, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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[X] Further documents are listed in the continuation of Box C. [X] See patent family annex.

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"A" document defining the general state of the art which is not considered to be of particular relevance
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"P" document published prior to the international filing date but later than the priority date claimed
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Date of the actual completion of the international search	Date of mailing of the international search report
9 January 2003	10 -01- 2003
Name and mailing address of the ISA/ Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. +46 8 666 02 86	Authorized officer Per-Olof Warnbo / JA A Telephone No. +46 8 782 25 00

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE 02/01783

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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Information on patent family members

01/12/02

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